

# Using MySQL for Learning Management System

Azali Saudi<sup>a</sup>, Siti Hasnah Tanalol<sup>b</sup>, Asni Tahir<sup>c</sup>

*Sekolah Kejuruteraan dan Teknologi Maklumat, Universiti Malaysia Sabah, 88999 Kota Kinabalu, Sabah*

*Tel : 088-320000 ext: 3035, Fax : 088-320348*

*E-mails: azali@ums.edu.my, hasnah@ums.edu.my, asnieta@ums.edu.my*

## ABSTRACT

*The Internet provides a new way of getting access to knowledge resources and materials. The Internet platform is proven provides an efficient way of communication among instructors, students and management using computers via network. However, an integrated learning management system (LMS) is required in order to have an efficient and effective communication, and to fully utilize the facilities provided by the Internet. There are already several implementations of such system, which are developed for commercial purpose, specifically for an organization or even provided in the public domain. This paper describes our work in utilizing open source tools particularly MySQL database, to develop web-based learning management system. The main focus is to evaluate the performance of MySQL, ease of usage, and platform dependency in a medium-scale project.*

## Keywords

*Knowledge sharing, Learning Management System, MySQL database.*

## 1.0 INTRODUCTION

The Internet offers tremendous potential as a ubiquitous teaching and learning delivery mechanism. The power of telecommunication technology and the Internet are not only driving an enormous implementation of e-Learning content, infrastructure, and services, but also the system integration as well as the learning management.

Learning management systems manage the administration of online teaching and learning activities. Managing online courses, registering students, tracking student progress and assessments are all part of managing learning. A learning management system (LMS) provides a

complete e-Learning infrastructure for creating, managing, tracking, delivering, and assessing e-Learning, whether in the classroom or online (Stylusinc, 2003). LMS are web-based programs that facilitate the creation, storage and delivery of unique learning objects, as well as the management of student rosters, and online collaboration.

Although the commercial e-Learning products are generic solution, the developers of LMS are motivated to build their own platforms because of many disadvantages of existing software platform (Francis and Emelo 2002). The main issue is whether the LMS can be integrated into the existing infrastructure and learning environment. Besides, a good LMS should be able to support the open architecture with technology standards such as Open Database Connectivity (ODBC) and Structured Query Language (SQL) (Institute of Management & Administration, 2003).

This paper is intended to discuss the design and development of a Web-based Learning Management System called E-Learning Platform (ELP) using MySQL database, an open source tool. Besides customizable and free, the advantage of open source solutions goes beyond cost savings (Yordanova et. al, 2003) The aim of the current study is to evaluate whether this approach is workable in case of building the ELP.

## 2.0 RELATED WORK

The e-Learning environment is different from traditional classroom delivery. Educational institutional that understand the issues of implementing effective e-Learning solutions can achieve the greatest success in the future. The Web and Web browsers; Internet Explorer and Netscape, have made the Internet more user-friendly with the ability to integrate multimedia elements such as graphics, animation, text, and sound into a single tool making new users do not have to struggle to learn. With e-Learning;

learning in real-time, 24/7, anywhere and anytime can be done. *TraineeTracker* is an e-Learning LMS software tools developed by a Phoenix-based Internet consulting company SofTrain Inc.; the software provides Internet-based solution for managing training material and content delivery. *TraineeTracker* includes source code, is customizable from design to functionality and runs on multiple database platforms: Linux, UNIX, Windows NT, SQL Server, Oracle, and MySQL. According to Barbara Stein (2003), *TraineeTracker* features includes:

- Login for registered users.
- Routing tool that manages course availability and selection for registered users.
- Add/Edit/Delete Users page
- Administrator can add/edit special accounts for groups of lessons and students.
- Managers can view/modify Manager and Student records.
- Survey results in a database can be accessed and viewed by an Administrator.
- Search Lessons feature (from Reference button).
- Personalized Web pages - Call variables from within the database to customize Web pages.
- Logout and security.
- Quiz scores.
- Administrator Reporting Function.
- Interactive conferencing system available for students/instructors communication.
- Runs on multiple platforms, including:
  - Windows NT/2000/XP with ColdFusion and MS Access or SQL Server
  - Linux with ColdFusion and MySQL

As an online tool for managing Web-based Training (WBT) it administrates courses, registration, students, results and delivery methods. As an LMS it also facilitate online learning with functions such as locating and accessing course, tracking learner progress and performance.

A study done to a sample of 995 students from selected Smart Schools in Malaysia; is to investigate the co-relation between e-learning application and multiple intelligence; seven

different ways students learn: verbal/linguistic, logical-mathematical, visual/spatial, bodily kinesthetic, musical, interpersonal and intrapersonal. According to Gardner (1993) each student could learn in any one of these ways or through a combination of several ways. The overall result of the study indicates that the differences in intelligence, learning styles, experience with computer, and gender type have some impact on how students selected and use available online application for the purpose of learning (Krishnasamy K. et al., 2003). Two types of factors were to be considered when developing e-Learning application; according to Reeves & Harmon (1994) these factors are user interface and pedagogical factors. User interface is concerns with the design of the software; on how the learner can actually be engaged in interacting with the software, while pedagogical factors is looking into the aspect of the software that affect learning. In this research the emphasized is on pedagogic factors especially accommodations of individual differences and user activity with the intention of answering: what are the most appropriate features to be included in the proposed educational application so as to cater student's learning styles differences in accordance with their intelligences? The result of the study suggested that developers of e-Learning to explore and apply the learning style features to the e-Learning development work (Krishnasamy K. et al., 2003).

Modular Object-Oriented Dynamic Learning Environment (MOODLE) is another open-source software package for creating Internet-based courses. The current study in Trakia University is to discuss the implementation of an Open-source Learning Management System platform using MOODLE for establishment of Web-based course on Communication ad Information Systems subject (Yordanova, 2003). This LMS is built using PHP and supports MYSQL database management systems. Students and instructors have only one account for the system and have different access rights. Like other LMS tools instructor have full control over the course content. Event notification is supported in the form of PHP script, which runs periodically according to instructor choice.

Originally developed at MIT **.LRN** is another open source web applications and a portal framework for supporting course management, online communities and collaboration. There are two basic components of the **.LRN** architecture: a

scalable, robust Relational Database Management System (RDBMS) and a web toolkit. .LRN is compatible with both Oracle (proprietary, expensive) and PostgreSQL (opensource, free) databases. The web toolkit is OpenACS, an advanced toolkit for building scalable, community-oriented web sites (2003 MIT Sloan).

Fle3 or Future Learning Environment is another example of a web-based learning environment. It is a server software for computer supported collaborative learning (CSCL) and support learner and group centered work. Fle3 is Open-Source, developed by Learning Environments for Progressive Inquiry Research Group UIAH Media Lab, University of Art and Design Helsinki in cooperation with Centre for Research on Networked Learning and Knowledge Building, Department of Psychology, University of Helsinki. The aim of computer supported collaborative learning (CSCL) environments is to provide students with advanced computer tools for knowledge production taking place in an interaction between the users (Scardamalia & Bereiter, 1993; 1994).

### 3.0 STRUCTURE OF THE LMS

The system is developed on a Linux system using Slackware 8.1 distribution. This distribution comes with all the tools required for this project. Recent version of other major distributions such as Redhat, Mandrake, Suse, and Debian are also possible. Linux is a UNIX clone operating system, which is initially developed for IBM PC compatible machine. Now, several ports has been written so that Linux can be run on many other platforms architecture including SPARC, Alpha and Embedded system. However, an effort is made so that the system's components can be developed on any platform. As the main development tools are all open sources, the design of the system is more flexible and the cost of development could be reduced as minimum as possible. The system development takes several phases to implement its core modules that include content provider, report generator, and administration panel.

The system consists of several components including Web server, Database, User interface and Web browser. All these components are provided in Linux Slackware distribution. Figure

1 illustrates the relationships among the components.

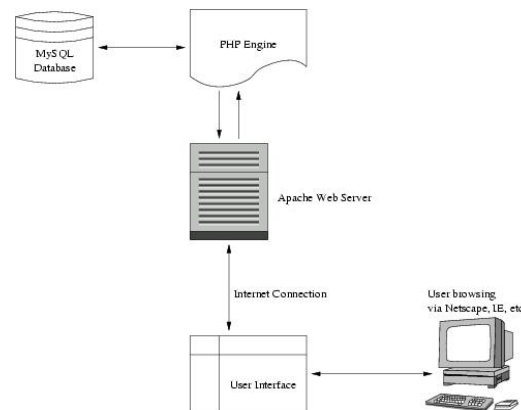


Figure 1: The LMS Architecture

### 3.1 Web Server

As a web-based application, a web server has to be setup to serve user request. Apache is chosen for several reasons. First, it is the most widely used web server in used today. It can be run on almost any major platform. Since the source code is also available, we can fine-tune it for our specific requirements. But even with its basic configuration, the Apache proves to be very stable.

In Slackware distribution, the Apache has been pre-configured, so that activating the server is just a matter of enabling several lines in the configuration file. By default, the configuration files is located at /etc/httpd/conf/httpd.conf. The Apache is well documented, and each line in the configuration file itself is self-explained.

The binary for the Apache can be downloaded at <http://www.apache.org>. The availability of Apache in many platforms allows the LMS to be installed on various operating systems.

### 3.2 MySQL Database

A database is an integrated system of files designed primarily to minimize repetition of data. The files of database are part of overall software that enables you to efficiently store, search, sort and retrieve data. Some of the major database software systems include Oracle, Sybase, PostgreSQL, MySQL, MS SQL Server, DB2, Interbase, and Informix.

The system uses MySQL database server, which is perhaps the most popular database among open source community. The MySQL server controls access to the data to ensure that multiple users can work with it concurrently, to provide fast access to it, and ensure only authorized users can obtain access (Welling and Thompson, 2001). Hence, MySQL is a multi-user, multi-threaded server. It uses SQL (Structured Query Language), the standard database query language worldwide.

MySQL has been publicly available since 1996, but has a development history going back to 1979. It has now won the Linux Journal Readers' Choice Award three years running. MySQL is available under Open Source license, but commercial licenses are also available if required.

MySQL comes with well-documented C Application Programming Interface (API) for manipulating the database in a high-level language. But there also other wrapper library for interfacing MySQL with several other popular programming language including C++, Perl, PHP, Ruby, etc.

We choose PHP to program the system, for its several advantages discussed in the next section. MySQL is tightly integrated with PHP scripting. Even though PHP library for manipulating MySQL contains hundred of functions, you only need a few of them to fully utilized MySQL database, as listed below:

- a) `mysql_pconnect()`, that is used to initialize connection to MySQL database. It takes three argument, that are, host name, user name and password.
- b) `mysql_query()`, that takes SQL string to be executed in the database.
- c) `mysql_fetch_rows()`, to retrieve each rows from the object returns by function (b), and placed each fields into an array.

As an example, the following code is to display all records in table Users stored in LMS database:

```
<html>
<body>
<p>
<?
$db = mysql_pconnect(
    "localhost", "root", "");
if(!$db) exit;
```

```
$result = mysql_query("
    SELECT firstname, lastname
    FROM LMS.Users
");

while(1) {
    $row=mysql_fetch_row($result);
    if(!$row) break;

    echo $row[0].",";
    echo $row[1]."<br>";
}
?>
</body>
</html>
```

### 3.3 Browsing the Content

The user interface acts as a medium of communication between users and the system. As the system is a web-based application, the user interface is developed using Hyper Text Markup Language (HTML). For interactivity, the web pages are written in PHP.

PHP stands for PHP Hypertext Preprocessor. PHP is a server-side scripting language designed specifically for the web. Within an HTML page, PHP code can be embedded and will be executed each time the page is visited. The PHP code is interpreted at the web server and generates HTML or other output to the browser.

PHP also an Open Source product, originally written in 1994 by Rasmus Lerdorf. The current major version of PHP is 4. As a typical feature of modern programming language, PHP also support object-oriented programming (OOP).

In this project, the OOP method is used to provide a standard look for each page in ELP system. A super class is written to provide all the basic features of a page. Each class that represents a particular page than is derived from this super class.

The system can be browsed on any web browser that supports basic standard HTML syntax, e.g. Netscape, Internet Explorer, Opera and Mozilla. This allows the users to access the system even from old machines and character-based terminal display. It is our aim to restrict our usage of HTML, so that only standard HTML syntax is

used to ensure minimal requirement on the client side.

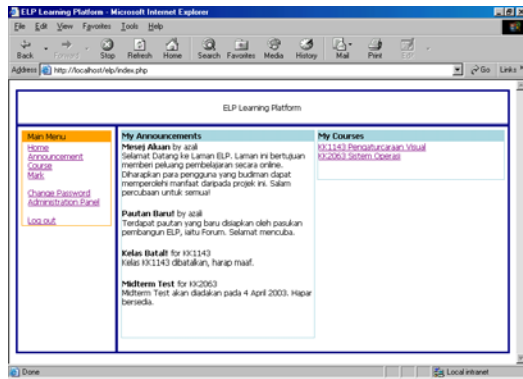


Figure 2: The index page of the ELP system browsed in Internet Explorer

Since each module for the system is derived from the same superclass (parent class), they carry the same look and feel. This characteristic minimizes the learning curve for user to browse the system. Some of the main modules of the system are:

- Retrieving course information and documents.
- Retrieving course mark/grade.
- Administration Panel.

Module (a) allows user to access course information such as course announcement, course documents, lecture notes, etc, through the Internet. This is the place where students can get the teaching materials for the courses they enrolled in. This module also provides a facility for course instructors to upload and manage their teaching materials.

One of the most popular modules among students is module (b). Here, students are able to browse their marks for the courses they enrolled in. Instructor enters the course marks using administration panel. The course marks are then automatically calculated by the system, and displayed when requested.

Module (c), Administration Panel is a module that provides system administration and materials management facilities. There are several options for administrating the system. The web-based interface allows remote administration via Internet. If the administrator on the LAN, he/she has the option to connect via TCP connection and administrating via mysql monitor, a bare

minimum command line interface, but very powerful to manipulate MySQL database.

If the administrator prefers a GUI-Based approach, there is also a web-based program, PHPMyAdmin that allows the administrator to connect through the Internet. This option, however, is strictly discouraged because the default configuration is not encrypted, thus vulnerable to network snoop. It is highly recommended that the PHPMyAdmin be only activated for a certain period, and disable when it is not needed.

### 3.4 User Authorization

One of the best features of MySQL is that it supports a sophisticated privilege system. A privilege is the right to perform a particular action on a particular object, and is associated with a particular user. The concept is very similar to file permissions. When a new user is added to MySQL, the user is granted a set of privileges to specify what he can do and cannot do within the system.

For this system, we implemented two types of user authorization: low-level and user-level authorization. The low-level authorization is used to grant direct raw access to MySQL database, which is restricted to superuser. The superuser, therefore, is allowed to modify the structure of the LMS database. MySQL provides two commands, GRANT to give rights to user, and REVOKE to take away rights from user.

The user-level authorization provides three levels of authorization, i.e. superuser, instructor and none (Azali and Hasnah, 2003). This level is implemented by creating a User table within the LMS database. The User table contains details of users who are granted access to the system, including user name, password and their role. The system options or features that are available to the users are based on their role specified in the User table. For example, Upload function is only available to Instructor role. The Student role, which is granted for the students, can be obtained via self- registration.

### 4.0 CONCLUSION

As a conclusion, the successful implementation of this system proved that MySQL is suitable for our medium-scale project. Since MySQL is freely available, it helps reduce the cost of the system development. MySQL comes with sufficient

documentation, thus reduces the learning curve for using the database. Most of the pages in the system only used the three PHP mysql functions explained in the previous section. Thus, contribute to the ease of use, compactness and readability of the source code.

MySQL is already ported to several platforms. Thus the database portion of the system can be easily move and installed to other architecture. Furthermore, all other components are also platform dependent, i.e. Apache web server and PHP script engine. Therefore the whole system can be easily ported to any preferred operating system.

## 5.0 REFERENCES

...LRN™ [Online] <http://dotlrn.org/index.html>. ©2003 MIT Sloan

... Human Resource Department Management Report, SECTION I. BUILDING & MANAGING e-LEARNING PROGRAMS: 12 Key Components to Consider When Shopping for an LMS, April 2002 pS14, ©2003 Institute of Management & Administration

...Stylusinc.com, Learning Management Systems - Globalizing e-Learning development [Online] <http://stylusinc.com/WebEnable/HR/LMS.php>

Francis, L., R. Emelo, Buy Versus Build: A Battle of Needs, [Online]. <http://www.learningcircuits.org/2002/jan2002/elearn.html>, 2002.

Krishnasamy K., Sai P. K. & Palaniappan S. (2003). E-Learning Application Based on Multiple Intelligences. Advanced Technology Congress, May 20-21, Putrajaya

Reeves, T.C., & Harmon. S.W. Systematic Evaluation Procedures for Interactive Multimedia for Education & Training. S. Reisman, Multimedia Computing: Preparing for the 21<sup>st</sup> century. (Idea Group Publishing, 1994) pp 472-505.

Saudi A. and Tanalol S.H., (2003). *The Development of E-Learning Platform*. Paper to be presented in International Symposium on e-Learning, 20-22 October 2003, Universiti Malaysia Sabah.

Scardamalia, M., & Bereiter, C. (1993). Technologies for knowledge-building discourse. Communications of the ACM, 36, 37-41.

Scardamalia, M., & Bereiter, C. (1994). Computer support for knowledge-building communities. The Journal of the Learning Sciences, 3, 265-283.

Stein B. (2003). TraineeTracker White Paper. [Online] <http://www.trainee tracker.com/whitepaper.html>

Welling, L. & Thomson. L., (2001). *PHP and MySQL Web Development*. Sams Publishing.

Gardner, H. (1993) "Frames of Mind: The Theory of Multiple Intelligences". London, Fontana.

Yordanova L., Boychev G., Tsvetanova Y., Hrisuleva V., Kiryakova G. (2003). Development of a Web-Based Course on Informatics via Open-Source Software Package MOODLE. International Conference on Computer Systems and Technologies. CompSys Tech'2003